

Translocation or bust! A new acclimatization agenda for the 21st century?

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There is little doubt that the species most at risk of extinction from rapid climate change are short-range endemics facing insurmountable dispersal barriers to potentially suitable alternative regions. Thomas [1] proposes that the only hope of avoiding extinction for these species is to undertake planned translocations. He argues that the benefits of translocation will outweigh the associated risks where translocations take place within the same broad geographic area and where the recipient areas lack local endemics [1]. While we agree that translocation of threatened species has a place in climate change adaptation, we disagree that translocating short-range endemics to endemism 'cold-spots' beyond their projected future 'native' range [2] is a viable low-risk strategy for conservation management; such translocations are nothing short of planned invasions [3]. We are compelled to point out that society is still paying the price for our 19th century adventure with planned invasions, in which Acclimatization Societies attempted to make far-flung regions of the British Empire resemble a British wildlife park. We believe that it is essential to avoid the implementation of *ad hoc* translocation schemes to the most expedient locations. Instead, the breakdown of the traditional 'pre-climate change' conceptualisation of static native range boundaries [4] demands that we reformulate a sound ecological framework to understand and predict future ranges, as well as the potential for translocations into these areas. We believe that an appropriate framework is to consider translocations only where a species is, or could be, considered native as defined by their 'projected dispersal envelope', which places a spatiotemporal context on reasonable species movements [2].

Unlike Thomas [1], we see no fundamental difference in whether these planned invasions occur within the same or different regions, as single-species translocations outside a species' natural range are intrinsically separating it from its natural enemies and competitors. The extensive invasion literature tells us that perhaps one in ten translocations will go on to naturalize, and one in ten of these will cause subsequent environmental or social harm [5]. With the substantial effort likely to be put into many translocation programmes, these proportions may be even higher, as observed for releases of biological control agents [6]. As Ricciardi and Simberloff [3] quite rightly observe, there is a litany of environmental risks (in addition to extinctions) associated with such intra-regional, as well

as inter-regional, invasions. We know that Thomas and colleagues recognise these risks also, as they write earlier that 'some short-distance translocations will be ill advised for recipient ecosystems and human communities' [7].

Part of the problem in weighing up concerns over such ill-advised translocations is the mismatch in relative risk between donor versus recipient ecosystems. In donor ecosystems, Thomas' focus on extinction over resilience [1] underestimates the intrinsic adaptive capacity of species in the face of climate change [8]. Whereas in recipient ecosystems, the potential for resilience over extinction in the face of planned invasions has been overestimated. The single-species translocations that Thomas contemplates are only likely to be viable for generalist species not reliant on prey or mutualists, yet the biocontrol literature tells us once again that these are exactly the species that raise the greatest spectre of severe non-target impacts in the recipient location.

Finally, we question the 'availability' of suitable endemism cold-spots to act as recipient regions around the world. Unlike the British situation, even a cursory examination of global range endemism distributions [9] shows that for climate-threatened species in the tropics and most of the southern hemisphere there would be few viable endemism cold-spots in an "area 'just outside' its former distribution". We should not forget that these low-endemism regions have their own unique ecology and natural character, that some might wish to conserve.

We should bear in mind that climate change adaptation is not just about mitigating extinction risk at any cost; it is also about mitigating and managing uncertainty of outcomes. We believe that translocations into non-native ranges will increase rather than decrease the uncertainty of management outcomes. Are we advocating, then, that certainty can be increased by letting climate-threatened species go extinct? No, not at all. Instead, we argue that if active management for *in situ* resilience is unlikely to be successful then *ex situ* conservation, rather than translocation, is the less risky option, avoiding the potential for non-target impacts and unexpected ecological surprises in recipient habitats.

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Letters

Jurassic Park? No thanks

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The conservation of endangered species is a major concern in the face of global change, yet *in situ* efforts to maintain threatened species are often unsuccessful because the historic environmental conditions that sustained populations of endangered species have since changed dramatically. Conservationists have long considered human-assisted colonization to more suitable environments as an alternative approach [1]. The option for assisted colonization has received renewed interest in the light of predicted impacts of climate change on endangered species [2]. Thomas [3] further develops this conservation option and provocatively suggests that the UK can represent an assisted regional colonization area (ARC) for imperiled Iberian species. Although general concerns regarding assisted colonization already exist [4], we use the specific example of the UK ARC to further illustrate the pitfalls of this approach.

First, climate change is not the main threat of most imperiled species and there are few examples of global species extinctions owing to climate change [5]. For example, the population decline of the Iberian lynx (*Lynx pardinus*) over the past 50 years is a result of human persecution, landscape fragmentation and disease, factors unrelated to climatic conditions [6]. The scarcity of extensive high-quality Mediterranean shrub vegetation is a primary reason for the ineffectiveness of conservation efforts in Spain. Rabbits, although a necessary condition for population persistence of lynx, are thus not sufficient to ensure lynx survival in the UK. Therefore, simply because areas of suitable climate are available, translocating species to these regions will not necessarily alleviate the risk of their extinction [7].

Second, human assisted colonization already has a long history through the deliberate and accidental introduction of alien species worldwide, and these events have themselves increased the pressure on endangered species, even if they have resulted in relatively few species extinctions [8]. The complex and interacting negative effects of introduced species on biodiversity, human health, cultural values and ecosystem services might only become evident decades after introduction [9]. Thus, even if few species extinctions, can be attributed to introduced species and introduced

species might increase the regional pool of species, it is naïve to assume that introductions are risk free.

Third, especially when advocating the translocation of iconic top predators such as the lynx, proponents need to be acutely aware of the potential for human–wildlife conflicts. Translocations of once extant predators in the UK have all met with opposition from different sectors of British society, even to the extent of persecution following release [10]. These conflicts also occur for introduced plant species regardless of the fact that they have a narrow distribution in the native range and are widespread in the UK. Public perceptions regarding rhododendron (*Rhododendron ponticum*) in UK are unlikely to be different if it were native, because indigenous grass, shrub and tree species that also colonize British heathlands are managed just as vigorously [11] to prevent changes in heathland ecosystem function. Thus, the suggestion that the UK should become a European wildlife park, with scant appreciation of the cultural as well as scientific value of native biodiversity, will probably become mired in the politics of public opinion, and threats to undermine such initiatives.

In sum, we advocate an integrative approach to mitigate the impacts of global change on endangered species that focuses exclusively on neither climate nor iconic taxa. We have to recognize that assisted colonization might face insurmountable governance issues. By not engaging in wishful thinking about ARCs, scientists, stakeholders and politicians will realize that only with concerted investment in *in situ* initiatives of a sufficient scale will endangered species have a future.

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